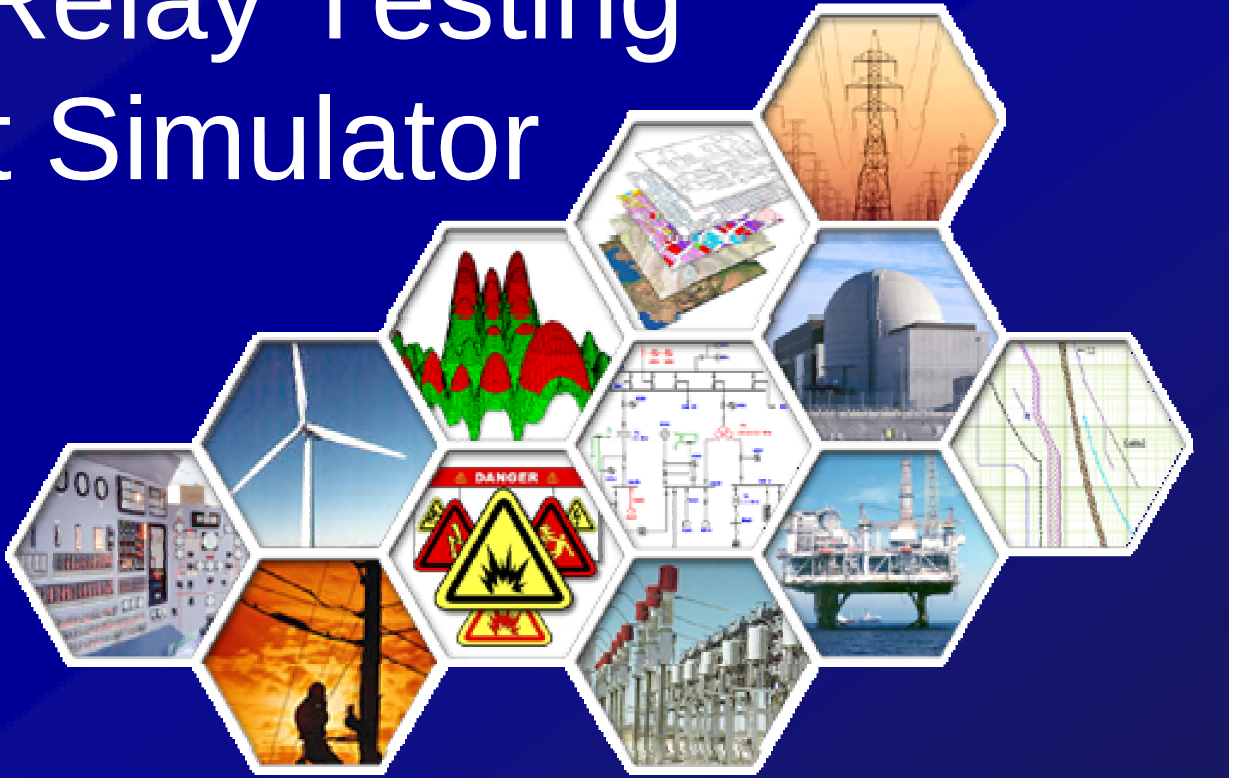
etap ARTTS

Advanced Relay Testing & Transient Simulator



ARTTS Overview

ETAP Advanced Relay Testing and Transient Simulator (ARTTS) is a state-of-the-art hardware and software for testing, calibrating, and simulating protective relays and other protection equipment.

ARTTS Overview

- Revolutionary method of analyzing and improving protective device coordination
- State-of-the-art technology for seamless testing, simulation and calibration of variety of relays
- Combines short-circuit and device coordination capabilities of ETAP Star with relay testing hardware (ARTTS)

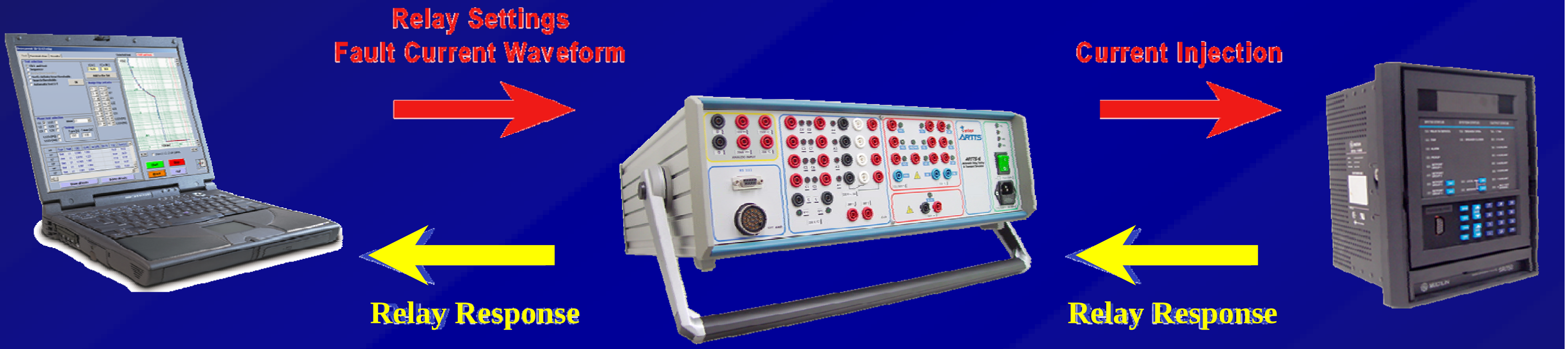
Capabilities

- Tests a variety of protective relay types including overcurrent, differential, and distance relays
- Test and calibrate energy meters, transducers and PQ meters
- Playback transient waveforms
- Provides actual steady-state and transient responses of relays for comparison with the manufacturers published data

ARTTS Package

- ARTTS Hardware
- ARTTS Software
- Star-ARTTS Interface
- ETAP Star Module

ARTTS Setup



Relay Settings
Fault Current Waveform

Relay Response

Current Injection

Relay Response

ARTTS Software
ETAP Star

ETAP ARTTS
Test Set
(Hardware)

Relay Under
Test

Benefits

- Improve system protection coordination
- Increase system reliability
- Reduce operational and maintenance costs by way of improved coordination
- Analyze deviation from nominal values
- Aid system engineers to identify possible relay false trips and make informed decisions

Key Features

- Historical database of relay simulation & testing data
- Direct Interface with ETAP Star
- Simulate transient fault response from ETAP
- Graphically compare & analyze actual relay response vs. manufacturer curve
- Playback transient signals from digital fault recorders, numerical relays
- Advanced software program for manual and fully automatic testing

Key Features

- High accuracy level – usually 0.02%
- Customizable test reports
- Up to 9 current and 7 voltage outputs
- Extremely easy-to-use, intuitive graphical user interface
- Realistic representation of panel control and vector quantities
- 'Click and Test' feature for efficient, quick testing

Star-ARTTS Interface

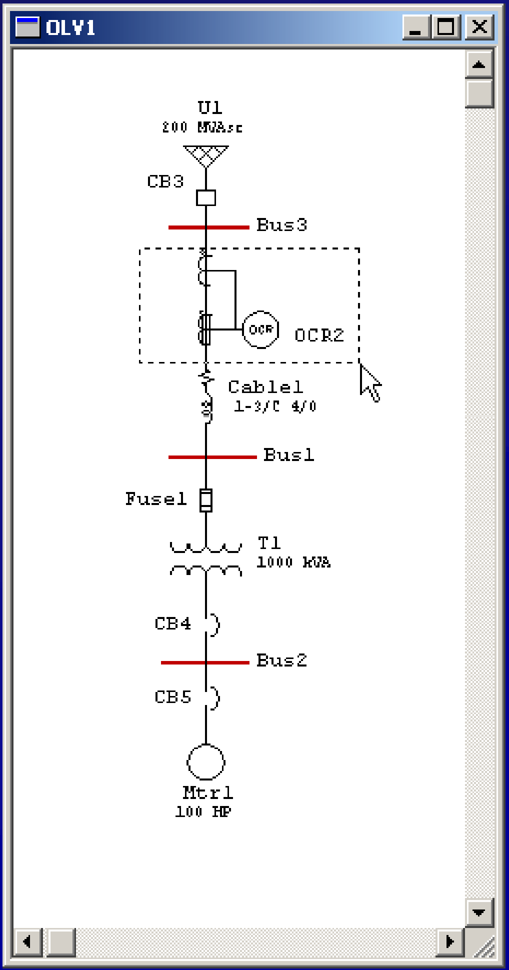
- Provides relay actual response
- Integrates relay testing with simulation
- Ability to simulate relay response under steady-state and transient conditions
- Useful tool for engineers and technicians to evaluate and make decisions on their protection system

Star-ARTTS Interface

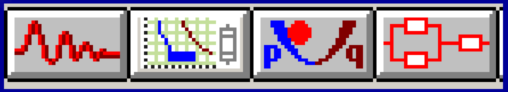
Steady-State Response

- ETAP Star exports relay settings and parameters to ARTTS
- Based on the input, ARTTS injects multiple currents into the relay under test
- Reconstruct the relay curve, based on actual relay response
- ARTTS imports the relay test results to ETAP Star for plotting and comparison with relay manufacturer data

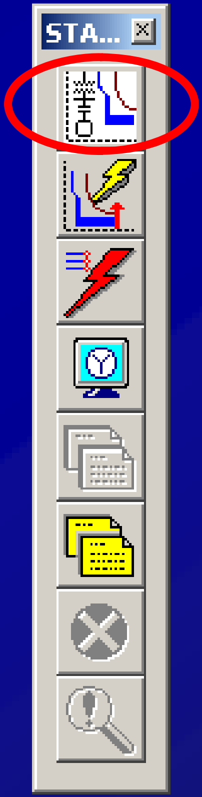
Star-ARTTS Interface


OLV1
U1
200 MVAsc
CB3
Bus3
OCR
OCR2
Cable1
1-3/C 4/0
Bus1
Fuse1
T1
1000 kVA
CB4
Bus2
CB5
Mtr1
100 HP

Select Relay

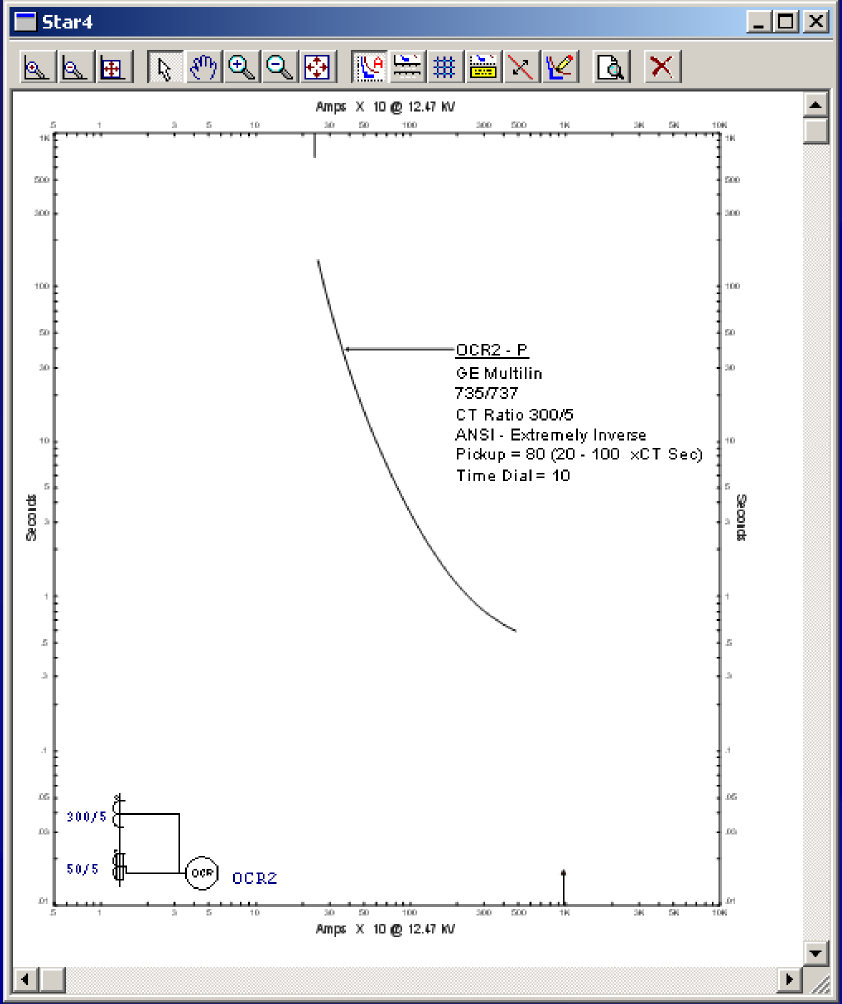


Go to Star Mode



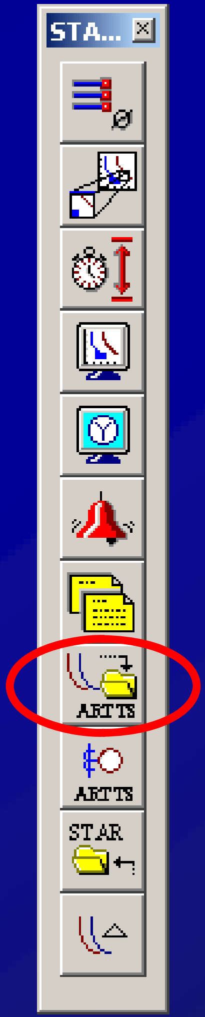
Create a Star View

Star-ARTTS Interface


Star4
Amps X 10 @ 12.47 kV
Seconds
300/5
50/5
OCR
OCR2

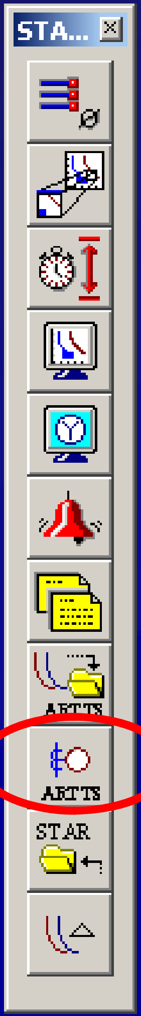
OCR2 - P
GE Multilin
735/737
CT Ratio 300/5
ANSI - Extremely Inverse
Pickup = 80 (20 - 100 xCT Sec)
Time Dial = 10

Select Relay Curve

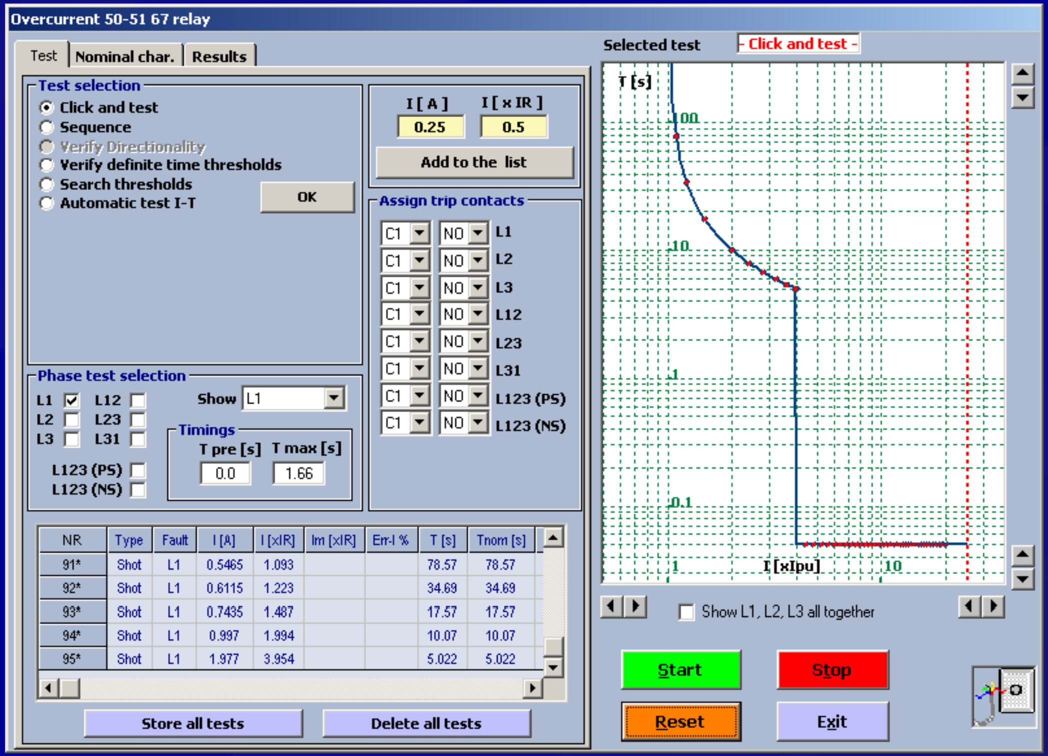

STA...
ARTTS
ARTTS
STAR

Export Relay Data to ARTTS

Star-ARTTS Interface


STA...
ARTTS
ARTTS
STAR

Launch ARTTS


Overcurrent 50-51 67 relay
Test
Nominal char.
Results
OK
Add to the list
T [s]
100
10
1
0.1
I [xIpu]
1
10
Start
Stop
Reset
Exit
Store all tests
Delete all tests

Selected test: Click and test

Test selection

- ● Click and test
- ○ Sequence
- ○ Verify Directionality
- ○ Verify definite time thresholds
- ○ Search thresholds
- ○ Automatic test I-T

I [A]	I [x IR]
0.25	0.5

Assign trip contacts

C1	NO	L1
C1	NO	L2
C1	NO	L3
C1	NO	L12
C1	NO	L23
C1	NO	L31
C1	NO	L123 (PS)
C1	NO	L123 (NS)

Phase test selection

L1 ☑ L12 ☐
L2 ☐ L23 ☐
L3 ☐ L31 ☐
L123 (PS) ☐
L123 (NS) ☐

Show: L1

Timings

T pre [s]: 0.0
T max [s]: 1.66

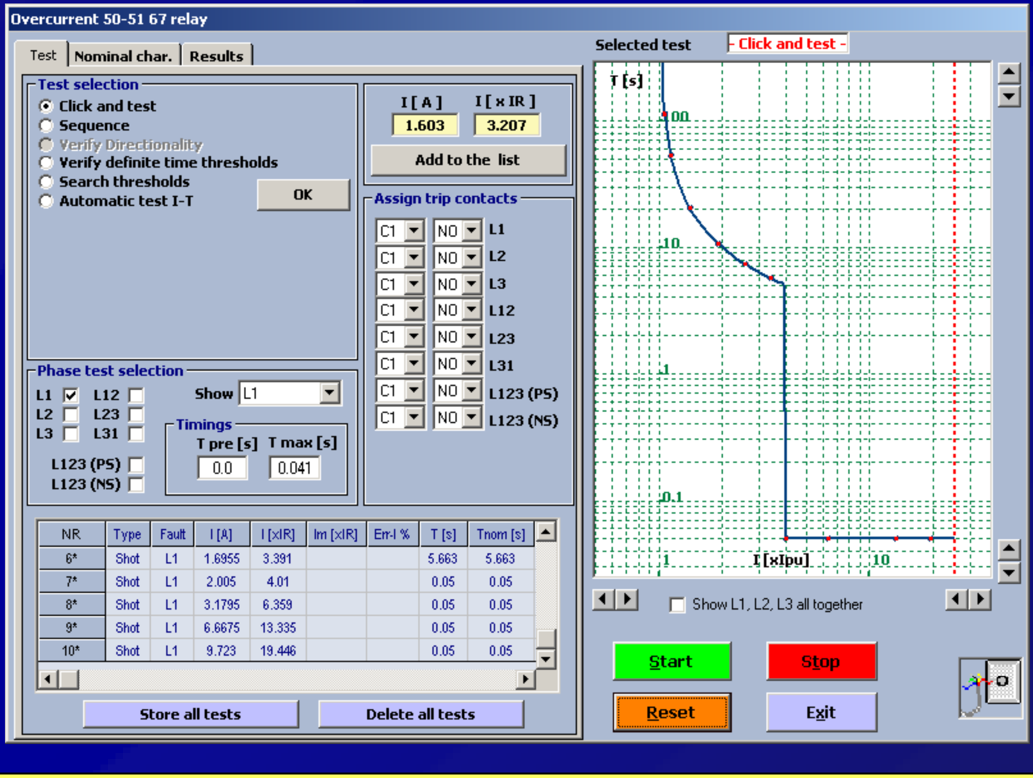
NR	Type	Fault	I [A]	I [xIR]	Im [xIR]	Err-I %	T [s]	Tnom [s]
91*	Shot	L1	0.5465	1.093			78.57	78.57
92*	Shot	L1	0.6115	1.223			34.69	34.69
93*	Shot	L1	0.7435	1.487			17.57	17.57
94*	Shot	L1	0.997	1.994			10.07	10.07
95*	Shot	L1	1.977	3.954			5.022	5.022

☐ Show L1, L2, L3 all together

ARTTS X-pro (Z-pro)

ARTTS X-Pro Software

- X-PRO module for testing Overcurrent, Directional, Line differential,…relays


Overcurrent 50-51 67 relay
Test
Nominal char.
Results
OK
Add to the list
Store all tests
Delete all tests
Selected test
- Click and test -
T [s]
100
10
1
0.1
1
I [xIpu]
10
Start
Stop
Reset
Exit

Test selection

● Click and test
○ Sequence
○ Verify Directionality
○ Verify definite time thresholds
○ Search thresholds
○ Automatic test I-T

I [A] 1.603
I [x IR] 3.207

Assign trip contacts

C1	NO	L1
C1	NO	L2
C1	NO	L3
C1	NO	L12
C1	NO	L23
C1	NO	L31
C1	NO	L123 (PS)
C1	NO	L123 (NS)

Phase test selection

L1 ☑ L12 ☐
L2 ☐ L23 ☐
L3 ☐ L31 ☐
L123 (PS) ☐
L123 (NS) ☐

Show L1

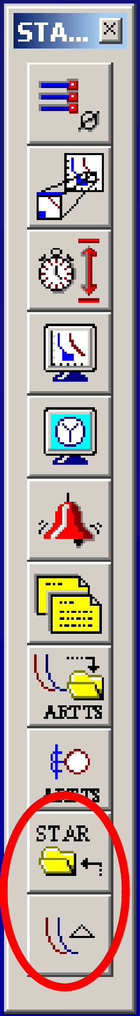
Timings

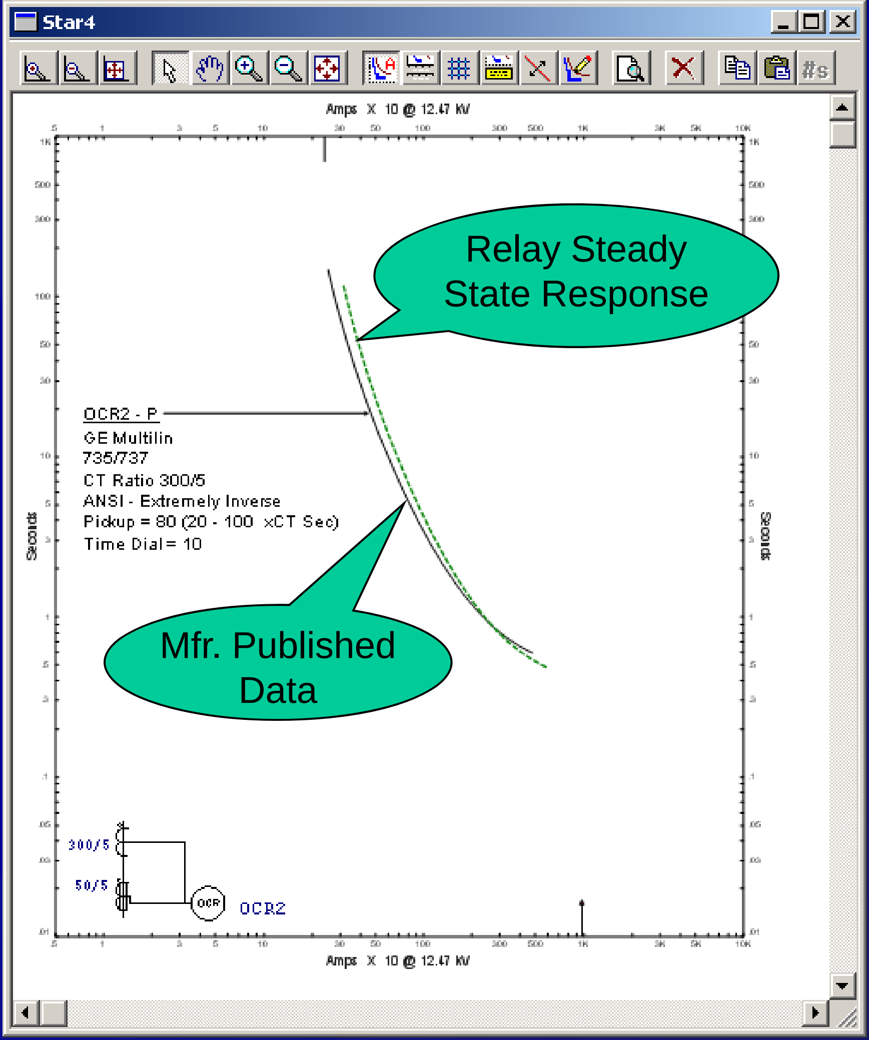
T pre [s] 0.0
T max [s] 0.041

NR	Type	Fault	I [A]	I [xIR]	Im [xIR]	Err-I %	T [s]	Tnom [s]
6*	Shot	L1	1.6955	3.391			5.663	5.663
7*	Shot	L1	2.005	4.01			0.05	0.05
8*	Shot	L1	3.1795	6.359			0.05	0.05
9*	Shot	L1	6.6675	13.335			0.05	0.05
10*	Shot	L1	9.723	19.446			0.05	0.05

☐ Show L1, L2, L3 all together

Star-ARTTS Interface


STA...
ARTTS
STAR

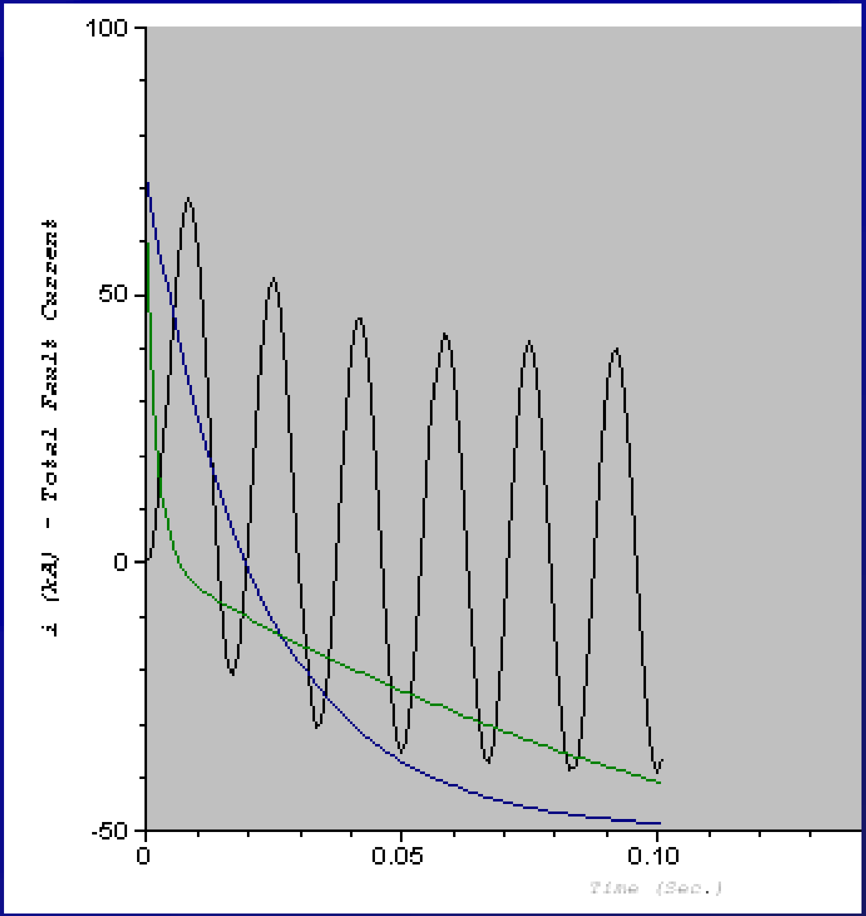

Star4
Amps X 10 @ 12.47 kV
Seconds
Relay Steady State Response
Mfr. Published Data
300/5
50/5
OCR
OCR2

OCR2 - P
GE Multilin
735/737
CT Ratio 300/5
ANSI - Extremely Inverse
Pickup = 80 (20 - 100 xCT Sec)
Time Dial = 10

Import Test Results to Star & Compare in Star View

Transient Response

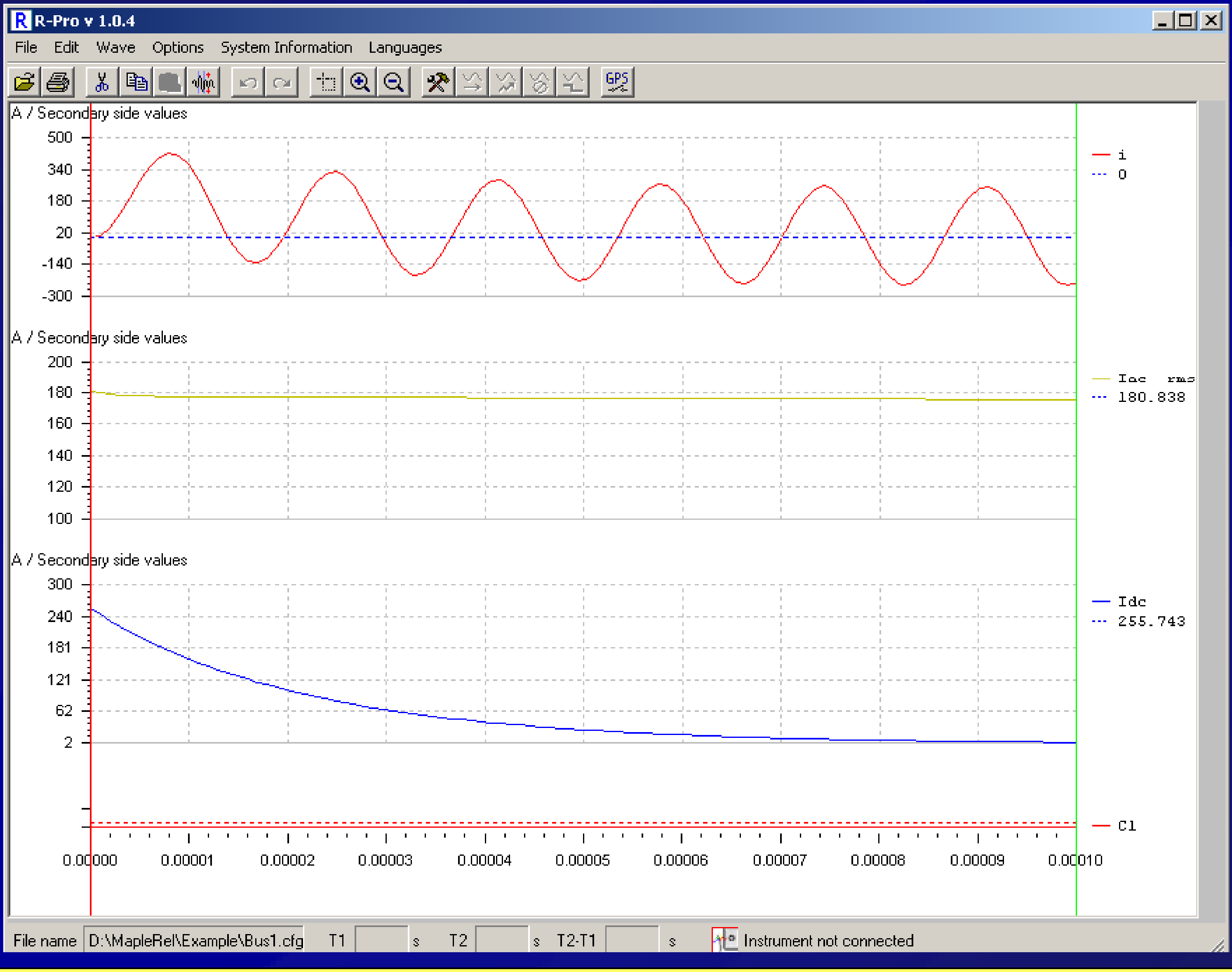
- Transient simulation required to obtain Actual Relay Response time on the through fault current
- Current waveforms obtained from ETAP Transient Short-circuit study exported to ARTTS in COMTRADE format



Transient Response

- Waveform playback in ARTTS using R-Pro software
- Waveform generated passed to relay under test (through ARTTS hardware)
- Verifies relay operation under conditions matching actual system faults
- Obtain actual response time & plot in Star View

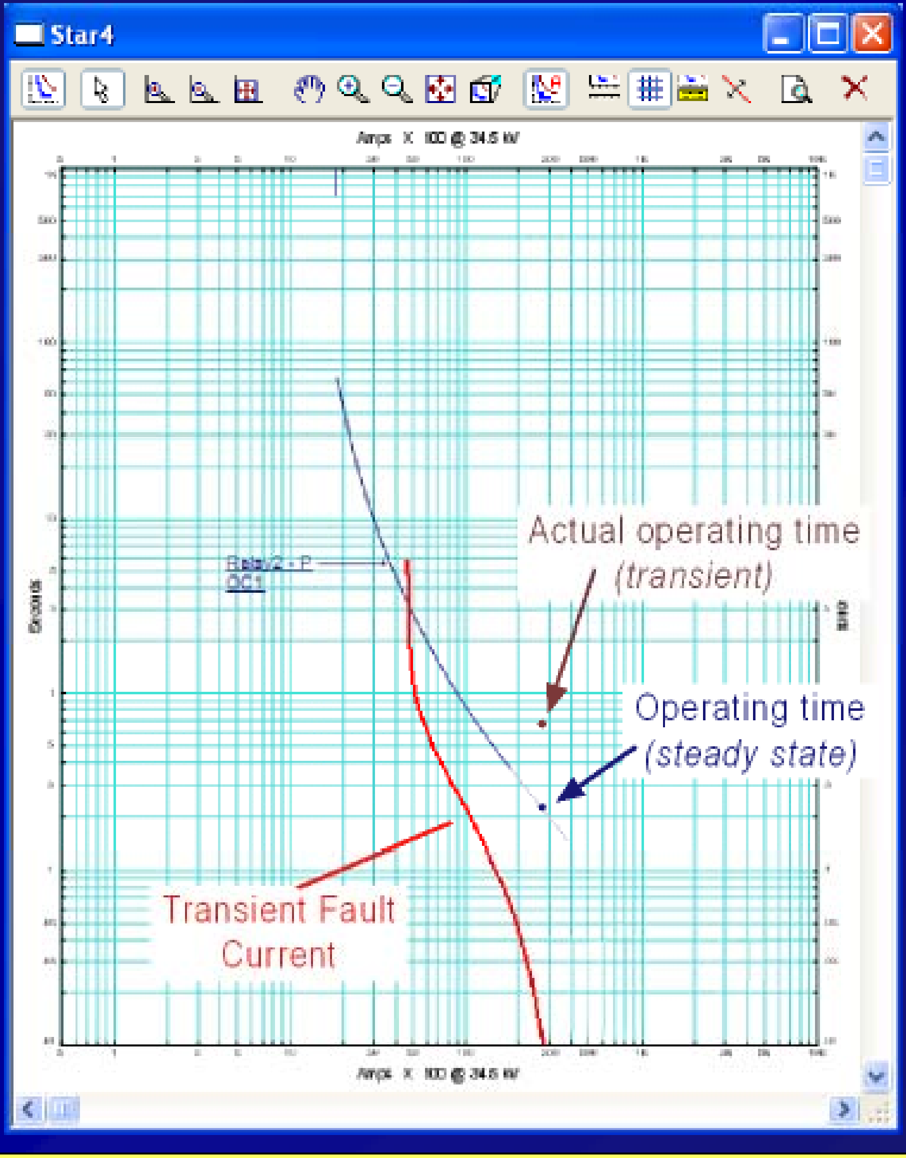
ARTTS R-Pro Software


R-Pro v 1.0.4
File
Edit
Wave
Options
System Information
Languages
GPS
A / Secondary side values
500
340
180
20
-140
-300
i
0
A / Secondary side values
200
180
160
140
120
100
Iac rms
180.838
A / Secondary side values
300
240
181
121
62
2
Idc
255.743
C1
0.00000
0.00001
0.00002
0.00003
0.00004
0.00005
0.00006
0.00007
0.00008
0.00009
0.00010
T1
s
T2
s
T2-T1
s

File name D:\MapleRel\Example\Bus1.cfg

Instrument not connected

Transient Response


Star4
Amps X 100 @ 34.5 kV
Seconds
Relay2 - P
OC1
Amps X 100 @ 34.5 kV

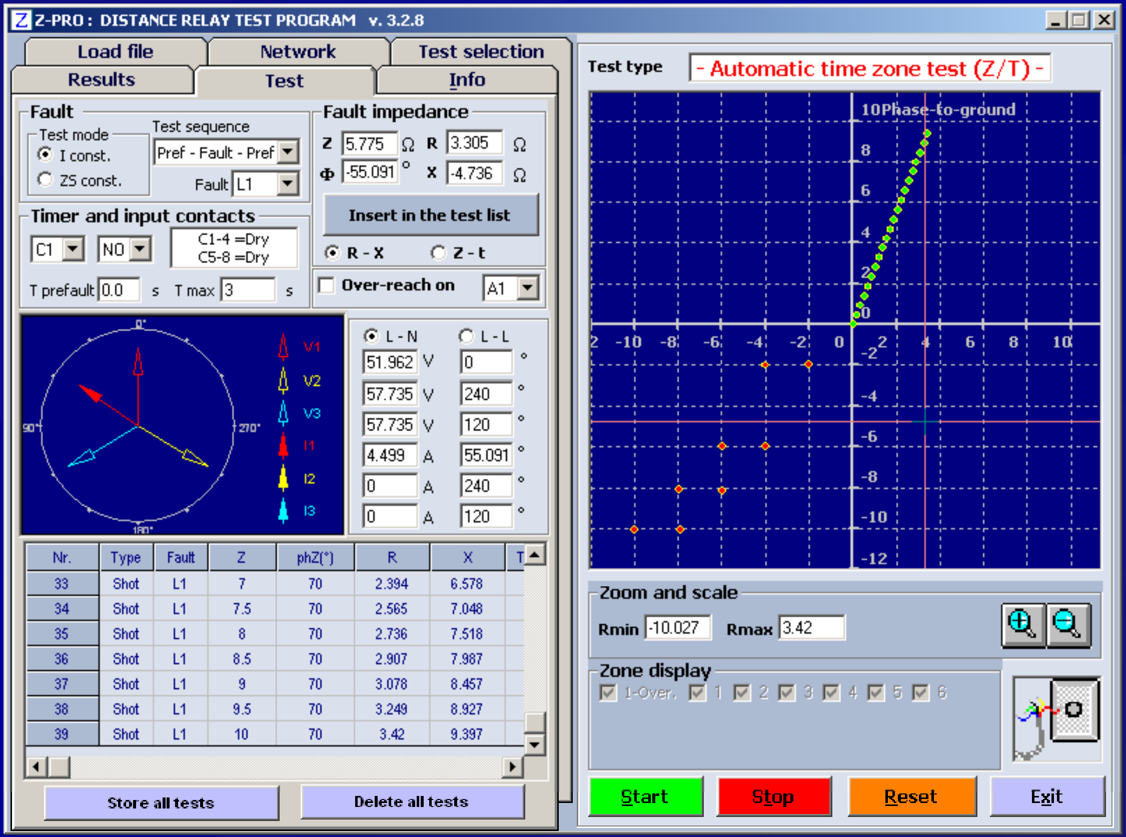
Actual operating time
(transient)

Operating time
(steady state)

Transient Fault
Current

ARTTS Z-Pro Software

- Z-PRO Module: For Testing Distance Relays


Load file
Network
Test selection
Results
Test
Info
Insert in the test list
Store all tests
Delete all tests
Start
Stop
Reset
Exit
0°
90°
270°
180°
V1
V2
V3
I1
I2
I3
10Phase-to-ground
8
6
4
2
0
-2
-4
-6
-8
-10
-12
10
Zoom and scale
Zone display

Z-PRO : DISTANCE RELAY TEST PROGRAM v. 3.2.8

Fault

Test mode: ● I const. ○ ZS const.

Test sequence: Pref - Fault - Pref

Fault: L1

Fault impedance

Z 5.775 Ω R 3.305 Ω

Φ -55.091 ° X -4.736 Ω

● R - X ○ Z - t

Timer and input contacts

C1 NO C1-4 =Dry C5-8 =Dry

T prefault 0.0 s T max 3 s

☐ Over-reach on A1

● L - N ○ L - L

51.962	V	0	°
57.735	V	240	°
57.735	V	120	°
4.499	A	55.091	°
0	A	240	°
0	A	120	°

Nr.	Type	Fault	Z	phZ(°)	R	X	T
33	Shot	L1	7	70	2.394	6.578	
34	Shot	L1	7.5	70	2.565	7.048	
35	Shot	L1	8	70	2.736	7.518	
36	Shot	L1	8.5	70	2.907	7.987	
37	Shot	L1	9	70	3.078	8.457	
38	Shot	L1	9.5	70	3.249	8.927	
39	Shot	L1	10	70	3.42	9.397	

Test type: - Automatic time zone test (Z/T) -

Rmin -10.027 Rmax 3.42

☑ 1-Over. ☑ 1 ☑ 2 ☑ 3 ☑ 4 ☑ 5 ☑ 6

ARTTS Software

- Measurement module for testing and calibrating energy meters, transducers and measuring meters
- Calibration module for calibrating ARTTS test set
- Programmer module